~~setting initial information including a number of wavelengths being used in the optical wavelength division multiplexing transmission apparatus and the wavelengths being used;~~

~~setting an amount of optical attenuation corresponding to each of the wavelengths to a maximum value;~~

~~determining when a variation in the number of wavelengths being input occurs; and~~

~~when a variation in the number of wavelengths being input occurs, controlling an amount of optical attenuation corresponding to the wavelength of the optical signal being input, so that the power level of the optical signal following the wavelength number variation is approximately constant, and so that the optical power level per single wavelength of the wavelength division multiplexed optical signal input into the optical amplification section is of a level which corresponds to the number of wavelengths following the determined variation in the number of wavelengths.~~

REMARKS

In the Office Action the Examiner noted that claims 1-7 were pending in the application and the Examiner rejected all claims. By this Amendment, claims 2 and 7 have been cancelled and various claims have been amended. In addition, new claim 8 has been added. The Examiner's rejections are traversed below.

The Rejections

In items 1-4 on pages 2-5 of the Office Action the Examiner has rejected the claims as unpatentable over U.S. Patent 6,094,296 to Kosaka, either taken alone or in combination with U.S. Patent 6,025,947 to Sugaya et al.

U.S. Patent 6,094,296 to Kosaka

The Kosaka patent is directed to an optical amplification apparatus for adjusting optical power of wavelength-multiplexed signal light at respective wavelengths, and for adjusting the optical output power at the respective wavelengths and a deviation of the optical power between the wavelengths.

As illustrated in Figure 5, Kosaka discloses an optical power adjusting unit 8 which adjusts the optical power of light at respective wavelengths as well as a deviation of the optical power between the respective light at the respective wavelengths. Then, the adjusted signal light is outputted to an optical amplifier unit 9 (column 5, lines 26-34). Thus, the optical power adjusting unit 8 amplifies or attenuates the light of at least one wavelength included in the WDM optical signal, independently from the light of other wavelengths.

<u>U.S. Patent 6,025,947 to Sugaya et al.</u>

The Sugaya et al. patent is directed to a controller which controls a variable optical attenuator to control the power level of a wavelength-multiplexed optical signal when the number of channels is varied. Sugaya discloses a control method for a WDM optical transmission system capable of transmitting optical signals that are stable with variation in channel numbers. Specifically, Sugaya et al. discloses controlling a light transmissivity and the like of an optical attenuator, so that WDM optical signals at a level corresponding to the number of channels are amplified and output, prior to varying the number of channels. Sugaya temporarily fixes the light transmissivity of the optical attenuator when notified of the variation in the number of channels, to adjust the output light level corresponding to the number of channels by operating an optical amplifier in accordance with automatic gain control. A light transmissivity control of the optical attenuator is started when the variation in the number of channels is completed by an automatic level control circuit.

<u>The Present Claimed Invention Patentable Distiguishes Over the Prior Art</u>

Referring to amended claim 1 which essentially corresponds to prior claim 2 as rewritten in independent form, in the Office Action the Examiner acknowleged that "Kosaka differs from the claimed invention in that Kosaka does not disclose a wavelength number variation processing step, switching the operation of optical amplifier from automatic level control to automatic gain control, and controlling the amount of attenuation following the wavelength number variation" (see page 4 of Office Action). However, the Examiner took the position that Sugaya discloses an optical multiplex transmission system wherein the multiplexed optical signals are attenuated, amplified and monitored. The Examiner further took the position that Sugaya discloses a monitoring step that monitors the variation of the number of wavelengths

and further discloses a control circuit for controlling the amount of attenuation by the optical attenuator and a control circuit for controlling the gain of the optical amplifier based on the result of the monitoring step. The Examiner further took the position that Sugaya discloses "controlling the amount of attenuation following the number variation so that the power level of the optical signal of each wavelength stays approximately constant." (See page 4 of the Office Action.)

The Examiner takes the position that when the input power is uniformly increased or decreased in order to obtain a constant gain and a constant power level, one of ordinary skill would have adopted an optical amplification apparatus capable of arbitrarily adjusting the optical output power of WDM signal light at respective wavelengths. The Examiner further took the position that it would have been obvious to one of ordinary skill to apply a monitoring unit or a control circuit as disclosed in Sugaya et al. to the Kosaka implementation in order to provide an optical amplification apparatus that detects variation in the number of channels and controls an optical attenuation amount and an optical amplifier gain based on the variation to provide "reduced non-linear degradation and s/n degradation and control the power level of the individual signals to be approximately constant (See page 5 of the office Action).

Contrary to the Examiner's position, it is submitted that the claimed invention as set forth in claim 1 is not taught by the prior art, either taken alone or in combination. Specifically, in Sugaya et al, it is disclosed in column 17, lines 52-59, that at the time of variation in the number of channels, the attenuation amount of optical signals by a variable optical attenuator 64 is maintained at a current level. In contrast, in the method of claim 1, the optical attenuation amount corresponding to the signal wavelengths of input light, is controlled so that the optical signal power level at the respective wavelengths to be analyzed by the spectral analysis section following the variation in the number of wavelengths, is maintained to be approximately a constant. In addition, the optical power level per one wavelength of the WDM optical signal's input to the optical amplification section becomes a level corresponding to the number of wavelengths following the variation.

It is submitted that the type of control disclosed in Sugaya et al. mainly relates to the control of the optical amplification section. Accordingly, the constant control of the optical power according to the number of wavelengths as disclosed in Sugaya et al. refers to the constant control of the total output power of the optical amplification section. Thus, Sugaya et al. does not disclose a control for the level deviation between respective wavelengths in the output of the optical amplification section. Further, Sugaya et al. discloses that the light transmissivity for the

optical amplification section is temporarily fixed at the time of variation in the number of wavelengths. Sugaya et al. does not disclose the control of the optical attenuation section at the time of variation in the number of wavelengths.

In accordance with the present invention, by controlling the optical attenuation section, it becomes possible to perform two types of control: (1) maintaining the level of each wavelength in the output of the optical amplification section to be constant; and (2) setting the total power of the input light in the input of the optical amplification section to the level corresponding to the number of used wavelengths.

By performing number (2) above, the input level of the optical amplification section is always maintained at the proper level within the operable range. Therefore, it becomes possible to maintain the optical amplification section at the proper operating point, and also to suppress the signal error relative to the variation in the number of wavelengths and the variation in input level to the optical attenuation section. Such results cannot be achieved by Sugaya et al. or Kosaka, either taken alone or in combination.

It is also noted that the Examiner acknowledges that Kosaka does not disclose or suggest control corresponding to the time of variation in the number of wavelengths.

In summary, it is submitted that none of the prior art teaches or suggests the claimed control method, including:

> "upon a variation in the number of wavelengths being input, switching the operation of said optical amplification section from automatic level control to automatic gain control, and controlling the amount of optical attenuation corresponding to the wavelength of the optical signal being input into said optical attenuation section so that the power level of the optical signal of each wavelength analyzed by said spectral analysis section following the wavelength number variation is approximately constant, and moreover so that the optical power level per single wavelength of the wavelength division multiplexed optical signal input into said optical amplification section is of a level which corresponds with the number of wavelengths following variation."

Therefore, it is submitted that claim 1 patentably distinguishes over the prior art.

Claims 3-6 depend, directly or indirectly from claim 1 and include all of the features of that claim plus additional features that are not taught or suggested by the prior art. Therefore, it is submitted that claims 3-6 patentably distinguish over the prior art.

New Claim 8

New claim 8 is also directed to a control method for an optical wavelength division multiplexing transmission apparatus which recites:

> "determining when a variation in the number of wavelengths being input occurs;
>
> when a variation in the number of wavelengths being input occurs, controlling an amount of optical attenuation corresponding to the wavelength of the optical signal being input so that the power level of the optical signal following the wavelength number variation is approximately constant, and so that the optical power level per single wavelength of the wavelength division multiplexed optical signal input into the optical amplification section is of a level which corresponds to the number of wavelengths following the determined variation in the number of wavelengths."

Therefore, it is submitted that claim 8 patentably distinguishes over the prior art.

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Summary

It is submitted that none of the references, either taken alone or in combination teach the present claimed invention. Thus, claims 1, 3-6 and 8 are all in a condition suitable for allowance. Reconsideration of the claims and an early notice of allowance are earnestly solicited.

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Please DELETE the Abstract in its entirely and substitute the attached new Abstract.

IN THE CLAIMS:

Please CANCEL claims 2 and 7.

Please AMEND the claims in accordance with the following:

1. (ONCE AMENDED) A method of controlling an optical wavelength division multiplexing transmission apparatus which is equipped with an optical attenuation section for attenuating individually the power level of each of a plurality of input optical signals of different wavelengths, an optical multiplexing section for multiplexing the optical signals of each wavelength which have been attenuated by said optical attenuation section and generating a wavelength division multiplexed optical signal, an optical amplification section for amplifying the wavelength division multiplexed optical signal generated by said optical multiplexing section, and a spectral analysis section for analyzing the spectrum of the wavelength division multiplexed optical signal amplified by said optical amplification section, wherein said method comprises:

[an initial setting step which,] upon startup of said optical wavelength division multiplexing transmission apparatus, [sets] setting initial information including the wavelengths being used and the number of wavelengths being used, [sets] setting the amount of optical attenuation corresponding to each wavelength of said optical attenuation section to a maximum value, and [sets] setting the operation of said optical amplification section to automatic level control[,];

[a level adjustment step which,] upon input to an optical signal of a wavelength corresponding to the wavelengths being used set in said initial information into said optical attenuation section, [control] controlling the amount of optical attenuation corresponding to the wavelength of the optical signal being input into said optical attenuation section so that the power level of the optical signals of each wavelength analyzed by said special analysis section are approximately constant, and moreover so that the optical power lever per single wavelength of the wavelength division multiplexed optical signal input into said optical amplification section is of a level which corresponds with the number of wavelengths being used set in said initial information[, and];

[an operation step which,] based on the analysis results from said spectral analysis

section, [controls] controlling the amount of optical attenuation corresponding to the wavelength of the optical signal being input into said optical attenuation section, so that the level conditions adjusted by said [level adjustment step] controlling the amount of optical attenuation, are maintained[.]; and

upon a variation in the number of wavelengths being input, switching the operation of said optical amplification section from automatic level control to automatic gain control, and controlling the amount of optical attenuation corresponding to the wavelength of the optical signal being input into said optical attenuation section so that the power level of the optical signal of each wavelength analyzed by said spectral analysis section following the wavelength number variation is approximately constant, and moreover so that the optical power level per single wavelength of the wavelength division multiplexed optical signal input into said optical amplification section is of a level which corresponds with the number of wavelengths following variation.

3. (ONCE AMENDED) A method of controlling an optical wavelength division multiplexing transmission apparatus according to claim [2]1 wherein said [wavelength number variation processing step,] switching the operation of said optical amplification section comprises, upon any reduction in the number of input wavelengths, [sets] setting the amount of optical attenuation corresponding to the interrupted wavelengths of said optical attenuation section to a maximum value.

4. (ONCE AMENDED) A method of controlling an optical wavelength division multiplexing transmission apparatus according to claim 1, further comprising, [a spectral analysis anomaly processing step which] upon occurrence of an anomaly in the analysis operation of said spectral analysis section [during said operation step, controls] controlling the amount of optical attenuation corresponding to each wavelength in said optical attenuation section so that the level of the optical signal of each wavelength output from said optical attenuation section is maintained at the output level which existed immediately prior to the occurrence of the anomaly.

5. (ONCE AMENDED) A method of controlling an optical wavelength division multiplexing transmission apparatus according to claim 1, wherein, [further comprising a supervisory control processing step, which,] when the operation of said optical amplification

section is switched to either automatic level control or automatic gain control, [generates] said method further comprises generating a supervisory control signal, which shows at least the operating conditions of said optical amplification section following switching, and then [send] sending it to the transmission path,

wherein said supervisory control signal is used for switching the operation of optical amplification sections incorporated in subsequent stage devices connected to said transmission path so as to match the operating conditions of the optical amplification section of said wavelength division multiplexing optical transmission apparatus.

6. (ONCE AMENDED) A method of controlling an optical wavelength division multiplexing transmission apparatus according to claim 5, wherein said generating the supervisory control [processing step] signal utilizes a supervisory control channel of different wavelength from the wavelengths of the optical signals incorporated in said wavelength division multiplexed optical signal, to send said supervisory control signal to the optical transmission path together with said wavelength division multiplexed optical signal.